

# Evolution of International Space Station Program Safety Review Processes and Tools



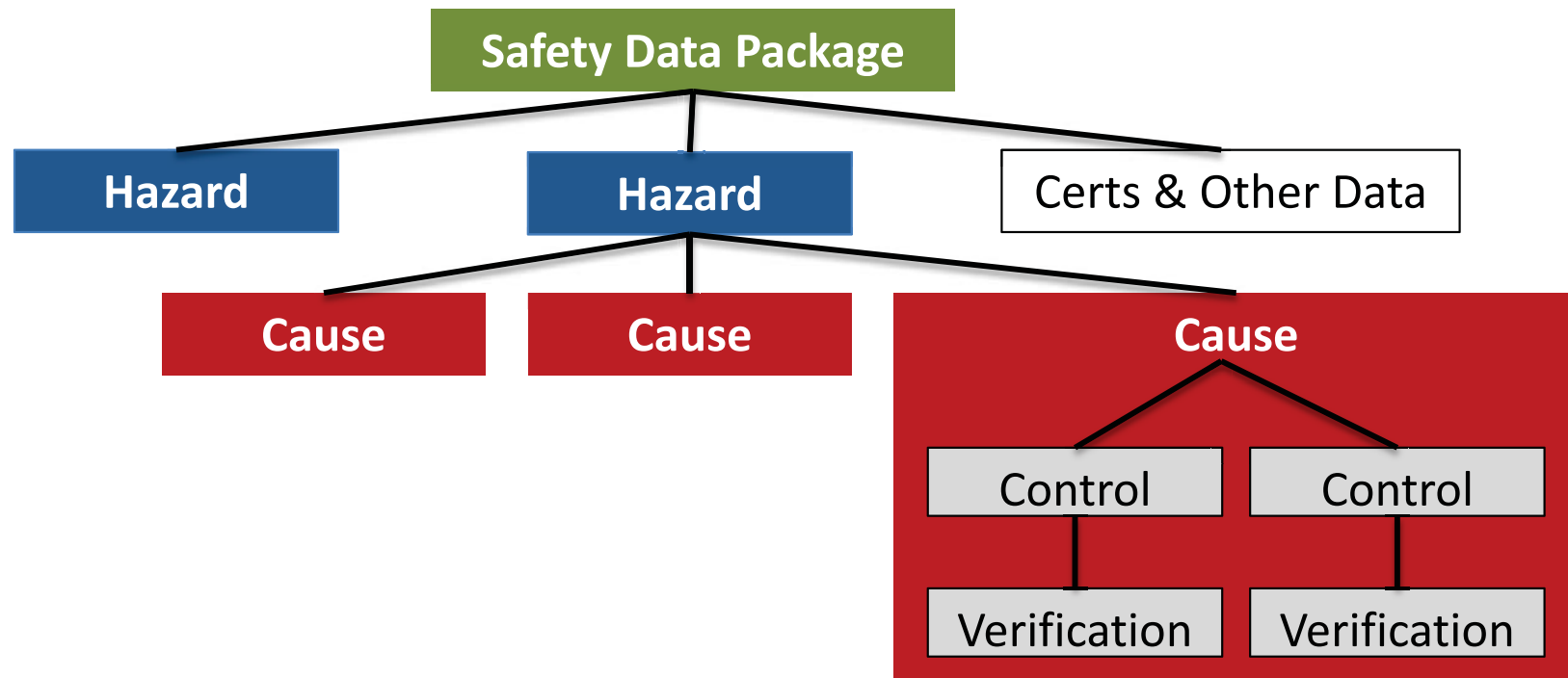
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Authors: Christian D. Ratterman, Collin Green, Matthew R. Guibert, Kristle I. McCracken, Anthony C. Sang, Matthew D. Sharpe, Irene V. Tollinger



# Safety & Mission Assurance

- The safe conduct of ISS operations is of great importance to NASA and International Partners
- One aspect of keeping ISS safe is careful analysis, tracking, and mitigation of Hazards





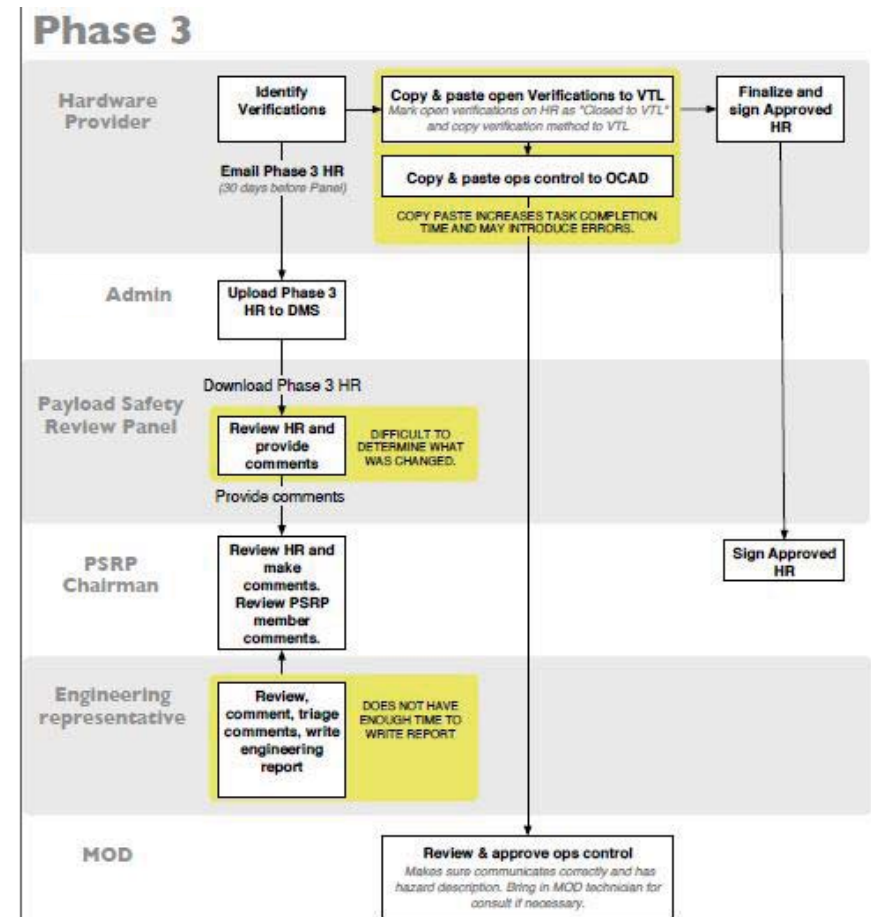
# The Need for a Change

- ISS transition from assembly phase to the sustaining & operations as an world class laboratory in low earth orbit.
- Continued need for safety review process for Research & Technology development
- The resource limitations and increasing demands drive process improvement to provide better ways of developing, capturing, and sharing safety documentation
- Broader work on ISS software improvement offered integration options with related S&MA and Engineering systems



# Process Evaluation & System Research

- Early 2011 process Audits (Kaizen) to identify improvements toward common and efficient processes
- Late 2011 System study (HCI user research and process analysis) to understand current state of processes & data management





# The New Hazard System

- Process, data collected, workflow and integrations configured without programming
- Directly link and integrate with authoritative S&MA tools
- Maintains common record format and process
- Data security and integrity
- Web-accessible data system
- Highly structured form entry of related Safety Data packages, Hazard Records, Cause Records, Controls and Verifications



# Benefits of Structured Hazards

- Minimize duplication of data
- Access & tracking of Data
- Process control
- Integration & reporting

## Structured Data (Database, XML)

Linked Causes

1	First Cause of this Hazard	Record 160
INWORK	Open	(No POC specified)
2	Second Cause of this hazard	Record 161
INWORK	Open	Kristle McCracken
3	Another Cause now 2	Record 102
APPROVED	Open Phase II Complete	Matt Guibert

Link More Causes:

Create New Cause Record

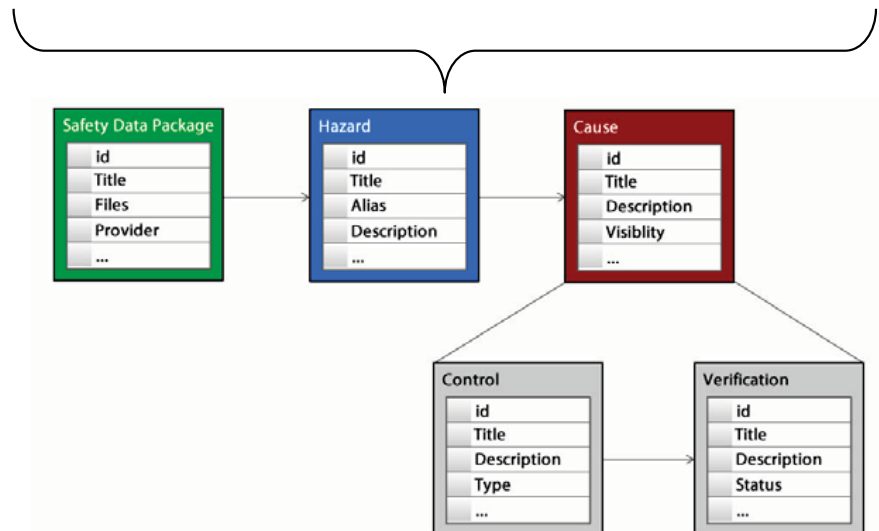
### Related Verifications:

- V.1 title
- V.2 another verificaiton

[Link More Verifications](#)

### Related Parts:

[Link More Related Hardware](#)





## Hazard

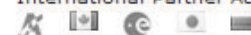
### Record 162 - INWORK

#### Example Hazard record (edit)

This is a **draft version**. [View all versions of this record.](#)

< prev (6 of 11 Search Results) next >

International Partner Access



Save

Basic  
Information

Related  
Documents

Approvals and  
Concurrences

CC: ☐ Myself (Christian Ratterman)  
0 users (edit)

\* Record Type: Hazard

◇ Hardware Category:

Hardware Provider: NASA JSC

\* Subsystem/Payload: General

Hazard Report Focal: Christian Ratterman (edit)

Report POC:

#### Linked Causes

1	First Cause of this Hazard	Record 160
INWORK	Open	(No POC specified)
2	Second Cause of this hazard	Record 161
INWORK	Open	Kristle McCracken
3	Another Cause now 2	Record 102
APPROVED	Open Phase II Complete	Matt Guibert

Link More Causes:

Create New Cause Record


Affected System:

◇ Interfaces:



**Cause**  
**Record 83 - INWORK**  
**Another Cause** (edit)

&lt; prev (27 of 188 Search Results) next &gt;

International Partner Access  [Save](#)Basic  
Information

Controls

Verifications

Detection and  
Warning  
MethodsRelated  
DocumentsApprovals and  
Concurrences

## Controls



CTRL1. Control 1

[Expand/Edit](#)**Controls ID:** CTRL2 [\(Delete\)](#)[Collapse](#)

Subcontrol ID:

## ◇ Control Type:

Design

definitions

## Control Title:

New Control 2

## ◇ Control Description:

Detailed description of the second control on this cause record.

## ◇ Control Flight Applicability:

---

## Related Verifications:

- [V.1](#) title
- [V.2](#) another verificaiton

[Link More Verifications](#)

## Related Parts:

[Link More Related Hardware](#)

CTRL3. Another Contorl

[Expand/Edit](#)



CR #: No information listed. (83)	Hardware Category: Integration Hardware Provider: Boeing	Record Type: Cause Closure Status: Open <u>Phase II Complete</u>	
Title: Another Cause			
Control(s):		Verification(s):	
<b>CTRL1.</b> The <del>full</del> -partial Control description <del>Design</del> <u>Operational</u> 34S		<b>1.1 (V-1)</b> <u>Detailed description of the first verification. This verification is used to verify two of the controls on this cause record.</u> Test Closed to VTL Verify Each Flight  Verification Estimated Completion Date: No information listed.	
<b>CTRL2.</b> <u>Detailed description of the second control on this cause record.</u> <del>Operational</del> <u>Design</u> —		<b>2.1 (V-1)</b> <u>Detailed description of the first verification. This verification is used to verify two of the controls on this cause record.</u> Test Closed to VTL Verify Each Flight  Verification Estimated Completion Date: No information listed.  <b>2.2 (V-2)</b> <u>Verification Information for the second verification</u> Inspection — —	
<b>CTRL3.</b> Detail on the control <del>Design</del> <u>Operational</u> —		<b>3.1 (V-3)</b> <u>Detailed information on the Operational Control that will cover the third control</u> <u>Ops Cntr (OCAD)</u> <u>Open</u> <u>Verify Once</u>  Verification Estimated Completion Date: <u>2013-06-06</u>	

Controls and Verifications

Cause Report #No information listed.

## Search

Search

Words 

## Record IDs

(comma-separated)

## Hazard Report Numbers

(comma-separated)

## Status

☐ UNCONFIRMED☐ INWORK☐ REVIEW☐ APPROVED

0 selected

## Category is any of

☐ Basic Hazard and Cause Forms☐ Form 1298 Creation

0 selected

## Hardware Provider is any of

☐ AI Solutions☐ AMES☐ ASI☐ Astrium

0 selected

## Subsystem/Payload is any of

☐ APAS☐ COL☐ CT☐ ECL

0 selected

## Record Type

☐ ---☐ Standard Hazard☐ Hazard☐ Cause

0 selected

## Hardware Category

☐ ---☐ GFE☐ Integration☐ Payload

0 selected

## Flight Applicability

☐ Assembly Complete☐ ALL Flights☐ Covers Subsequent☐ 32S

0 selected

## Severity

☐ ---☐ Catastrophic☐ Critical☐ Marginal

0 selected

## Likelihood

☐ ---☐ Probable☐ Infrequent☐ Remote

0 selected

Cause Description contains any of the words 

## Affected System

☐ ---☐ ISS Integrated

0 selected

Part Number contains any of the words Part Name contains any of the words 

## Record Status

## Closure Status Level

☐ ---☐ Open☐ Open Phase I Complete☐ Open Phase II Complete

0 selected

## Search by people

## Search by change

## Search by signature

## Search by field

Search within specific fields (boolean statements)

☐ NOT (negate all of the following)

New filter

Field  Criteria  Words  Or

And Add another boolean chart

☐ Remember as my default search

Sort results by: Reuse same sort as last time

Search

[Home](#) | [New](#) | [Charts](#) | [Search](#) | [Help](#)[Signatures](#) | [Saved Searches](#) | [Whining](#) | [Prefs](#) | [Admin](#)

Sun May 12 2013 21:20:14 PDT

Reporter: christian.d.ratterman@nasa.gov

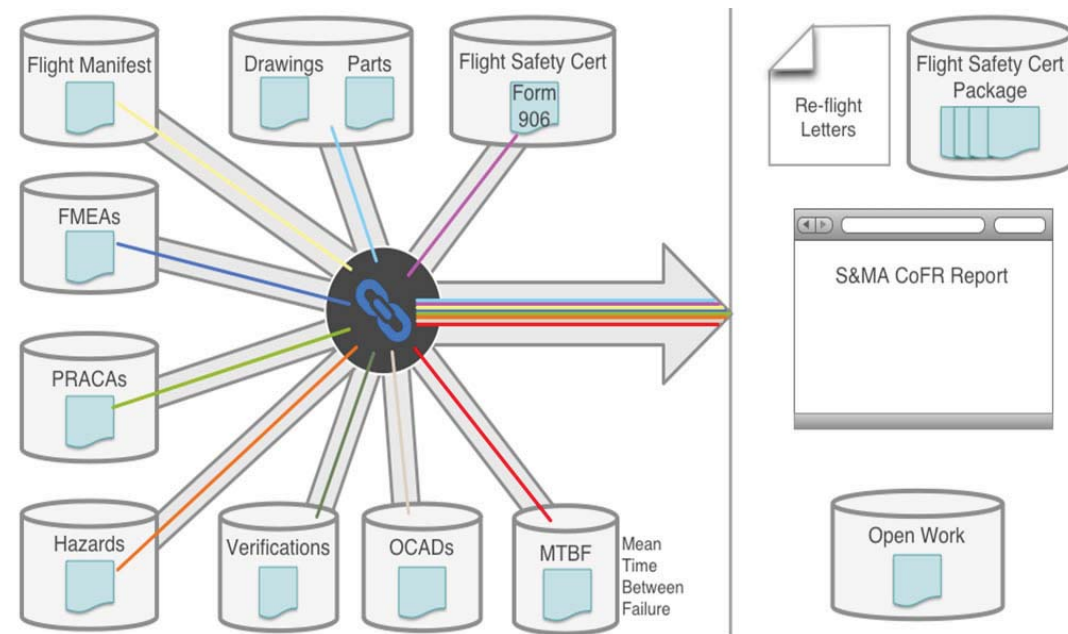
[Change Columns](#) | [Edit Search](#) | [Chart Search](#) | [Email Search Results](#) | [Save Search](#)43 records found | [View 8 Standard Hazards](#) | [View 11 Hazards](#) | [View 24 Causes](#)

Print	ID	Record Type	Hazard Report Focal Realname	Subsystem/Payload	Status	Closure Status Level	Title	Cause Description
	54	Hazard	Christian Ratterman	APAS	INWORK	Open	CDR Test Record ULF7	
	58	Cause	Christian Ratterman	APAS	APPROVED	Open Phase I Complete	Cause Test record 1	Test
	59	Cause	Christian Ratterman	APAS	APPROVED	Open Phase I Complete	Cause record 2	
	64	Cause	Christian Ratterman	APAS	APPROVED	Open Phase I Complete	New Cause	
	65	Cause	Christian Ratterman	APAS	REVIEW	Open	Cause Test record 1	Test
	68	Standard Hazard	Christian Ratterman	COL	INWORK	Open	Payload hazard for decompression	
	69	Hazard	Christian Ratterman	ENV	APPROVED	Open Phase I Complete	CDR Test Hazard record - Thursday	
	82	Cause	Christian Ratterman	ECL	INWORK	Open Phase I Complete	My first Cause	My Cause Detail
	83	Cause	Christian Ratterman	ENV	INWORK	Open Phase II Complete	Another Cause	Fill in the description
	102	Cause	Christian Ratterman	ENV	APPROVED	Open Phase II Complete	Another Cause now 2	Details on the Cause
	106	Cause	Christian Ratterman	ENV	INWORK	Open	My first Cause	My Cause Description
	110	Standard Hazard	Christian Ratterman	COL	INWORK	Open	My standard Hazard	
	113	Hazard	Christian Ratterman	MCH	REVIEW	Open Phase I Complete	Test Record CDR - Friday	
	123	Cause	Christian Ratterman	MCH	APPROVED	Open Phase I Complete	A first Test Cause	Needed more detail
	124	Cause	Christian Ratterman	MCH	INWORK	Open	Another Cause	
	128	Cause	Christian Ratterman	MCH	INWORK	Open	New number 2 record	New Cause Description
	135	Cause	Christian Ratterman	MCH	INWORK	Open	A first Test Cause	Needed more detail
	136	Standard	Christian Ratterman	General	INWORK	Open	Form 1298	



# Larger Goal & Ongoing Work

- The ISS Hazard System is just the beginning of capturing safety documentation in structured data systems capable of tight integration and automated status tracking
  - Flight Certifications
  - Verification Tracking & Operational Controls
  - Non-Compliance Reports
- Integration effort tying existing and new systems together to provide standardized and streamlined access to data
- The goal is to have an integrated system by end of FY2014





# Conclusion

- Evolve Hazard data collection to structured format
- Integrate key S&MA systems to simplify data tracking
- Increase in-context access to related data improves speed of access and understanding of data
- Reduce costs and improve safety through standardizing process and data management
- More efficient hazard analysis reduces errors and inconsistencies that compromise safety



# Point of Contact

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  - Christian Ratterman (Christian.D.Ratterman@nasa.gov)
- NASA JSC (ISS Safety)
  - Tony Sang (Anthony.C.Sang@nasa.gov)